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Tanaka

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(54) **SAW BLADE PROTECTORS**

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(73) Assignee: **Makita Corporation**, Anjo-shi (JP)

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B27B 3/28 (2006.01)
B26D 1/18 (2006.01)
B26D 1/14 (2006.01)
B27G 19/00 (2006.01)

(52) **U.S. Cl.** **83/478**; 83/102.1; 83/477.2; 144/251.1

(58) **Field of Classification Search** 83/102.1, 83/478, 477.2, 544, 520, 581, 477; 144/251.1, 144/251.3, 286.5, 287, 253.3
See application file for complete search history.

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(57) **ABSTRACT**

A saw blade protector for a cutting device having a table for placing thereon a workpiece, a saw blade protruding from an upper surface of the table, and a riving knife disposed in front of the saw blade in a moving direction of the workpiece for cutting the workpiece and positioned in line with the saw blade. The saw blade protector includes a guard plate constructed to cover the saw blade, a holding frame constructed to be mounted on an upper portion of the riving knife and to be able to support the guard plate, and an adjusting device constructed to be able to adjust a position of the holding frame relative to the upper surface of the table.

5 Claims, 11 Drawing Sheets

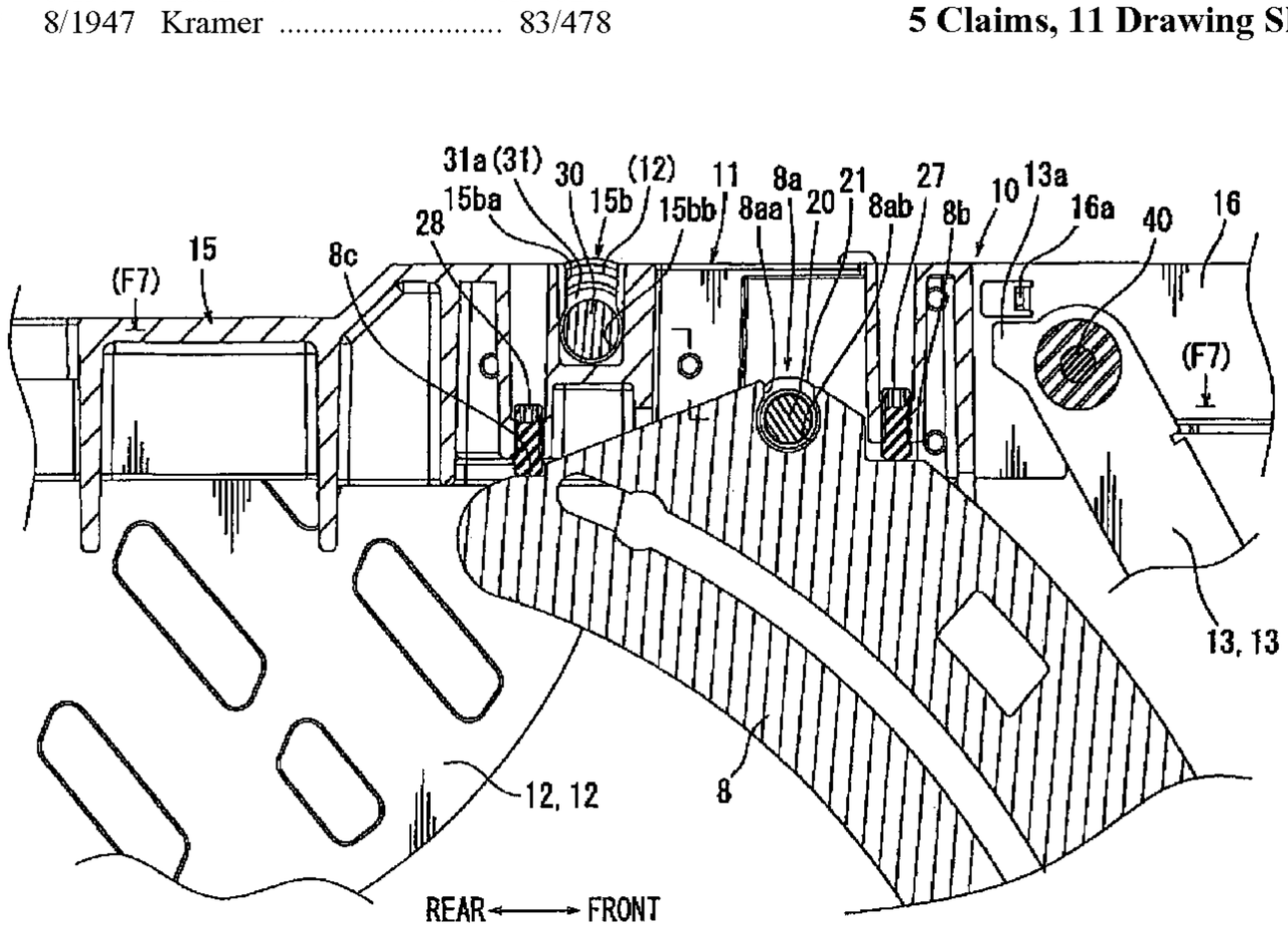
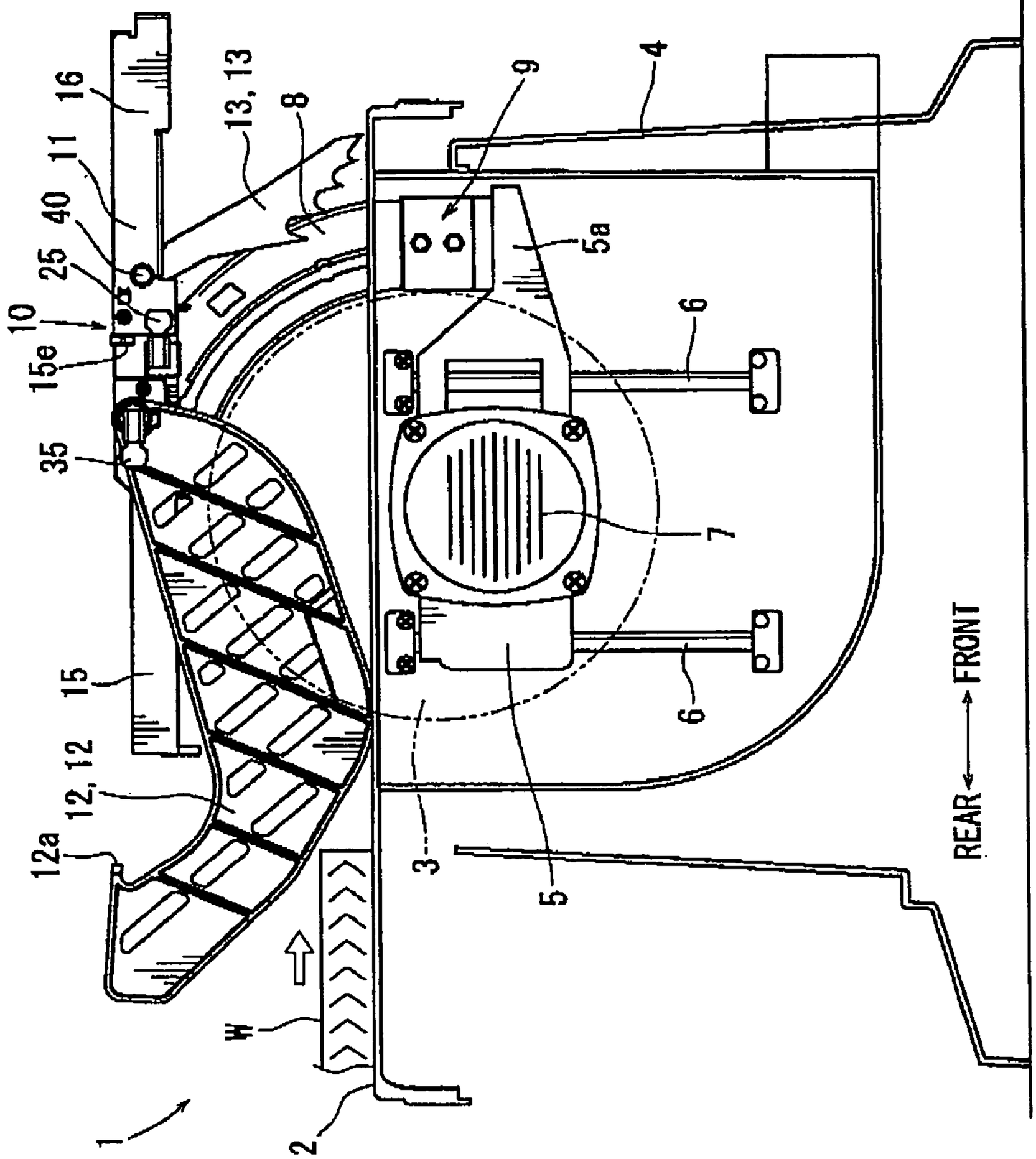


FIG. 1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H
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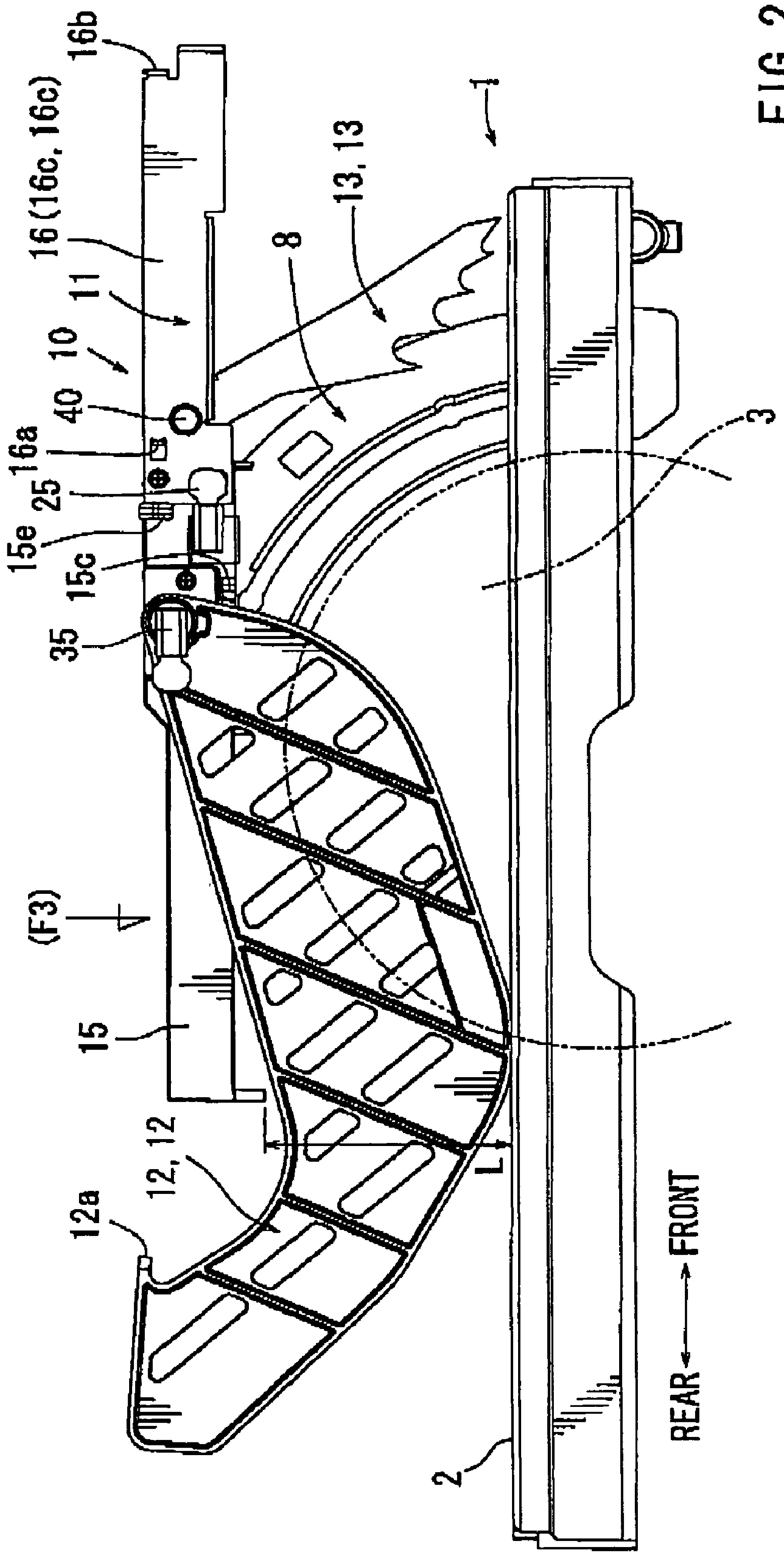
2
REAR
FRONT

FIG. 2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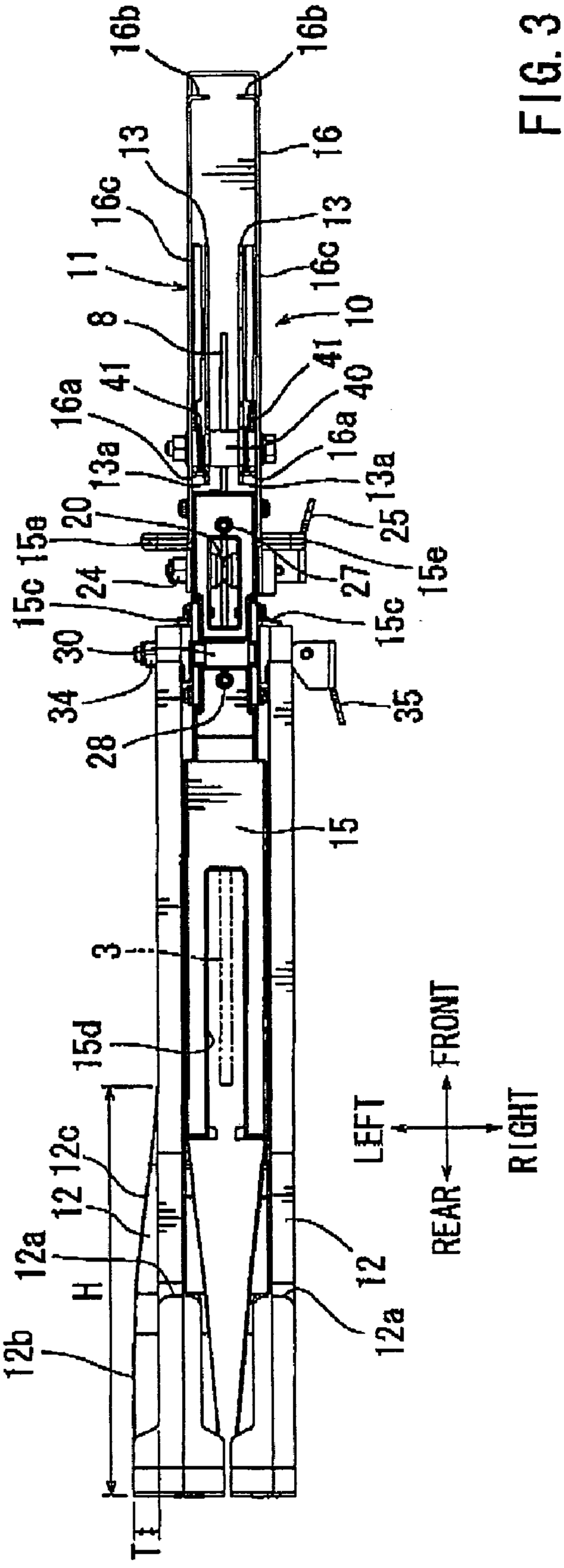
FRONT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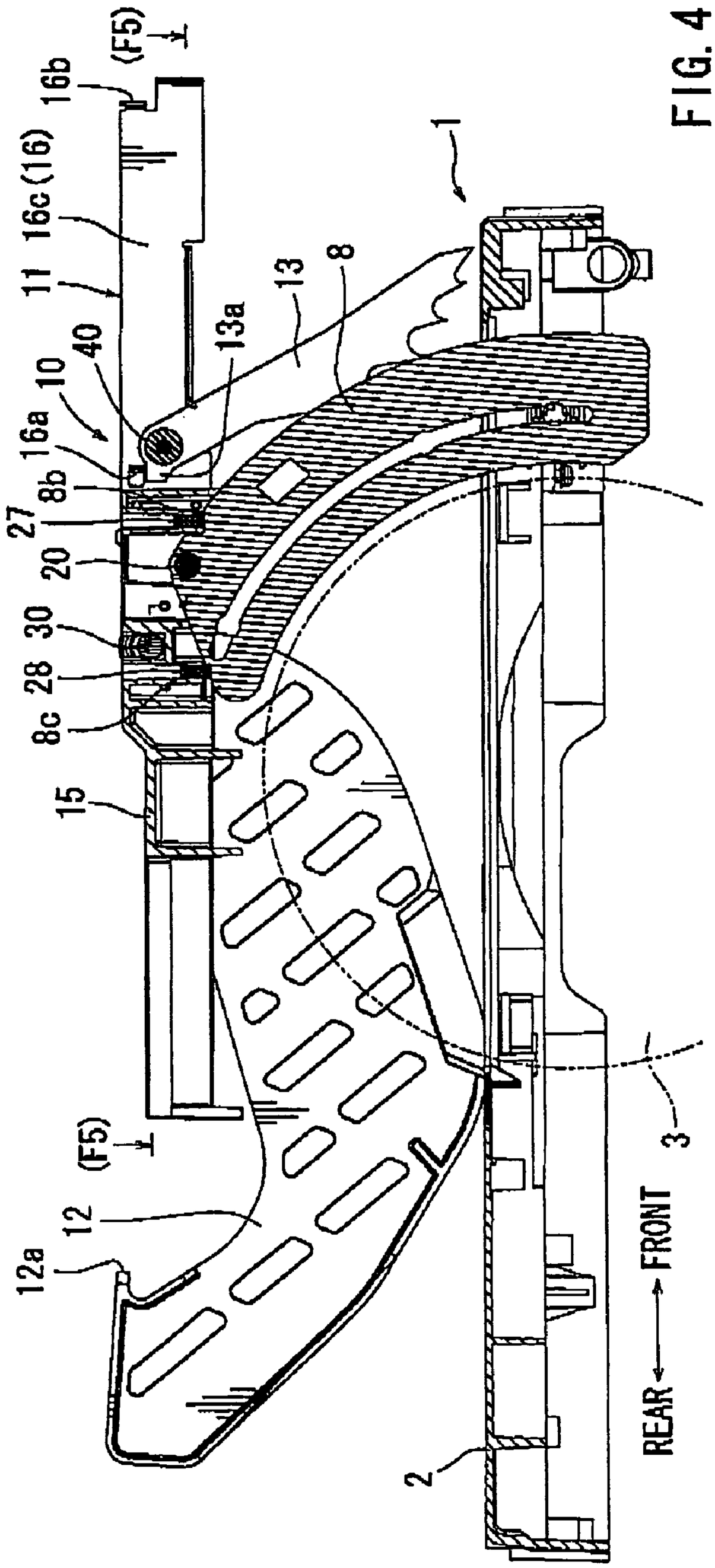
15a
15e
15c
24
27
15c
30
34
35
28
15
3
15d
FRONT
LEFT
REAR
RIGHT
12c
12
12a
H
12
12b
12a
T

FIG. 3

FIG. 4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8c
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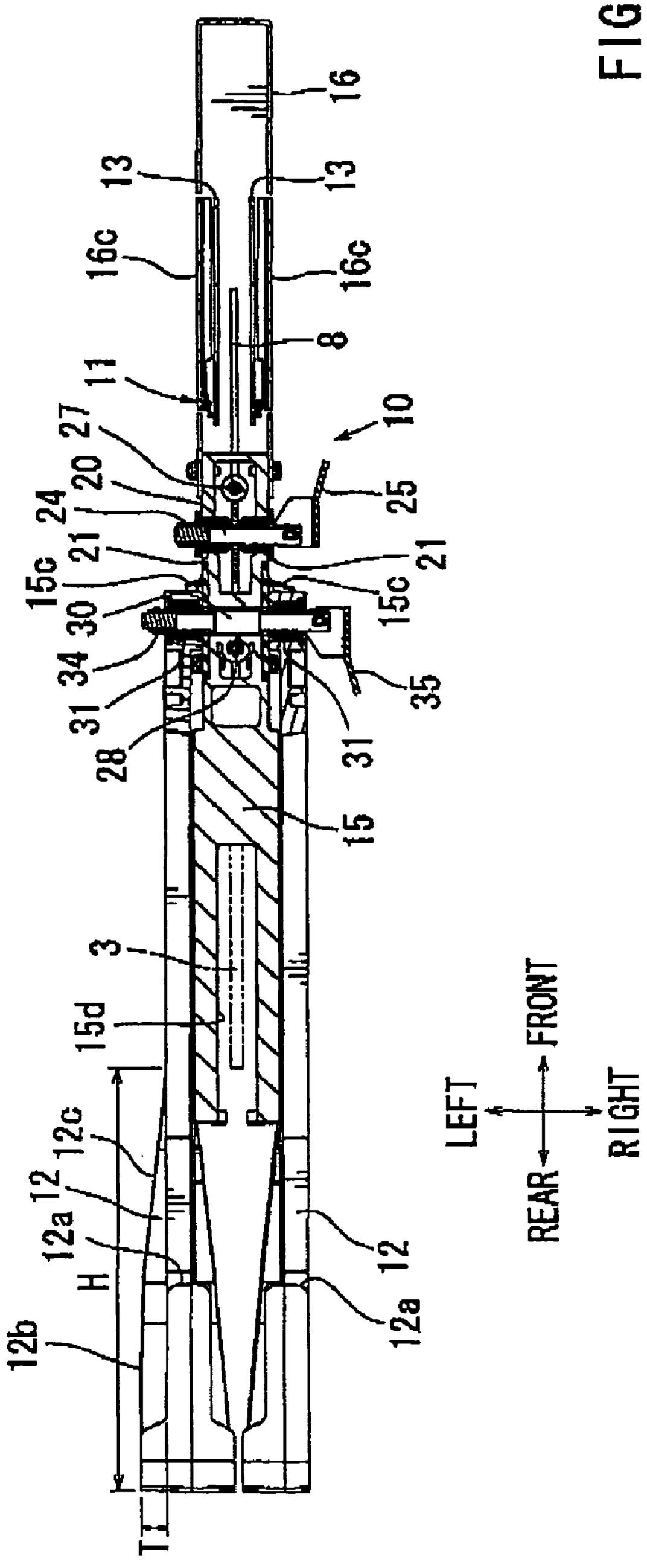
(F5)
13a
13
8
1
3
2
REAR
FRONT

FIG. 5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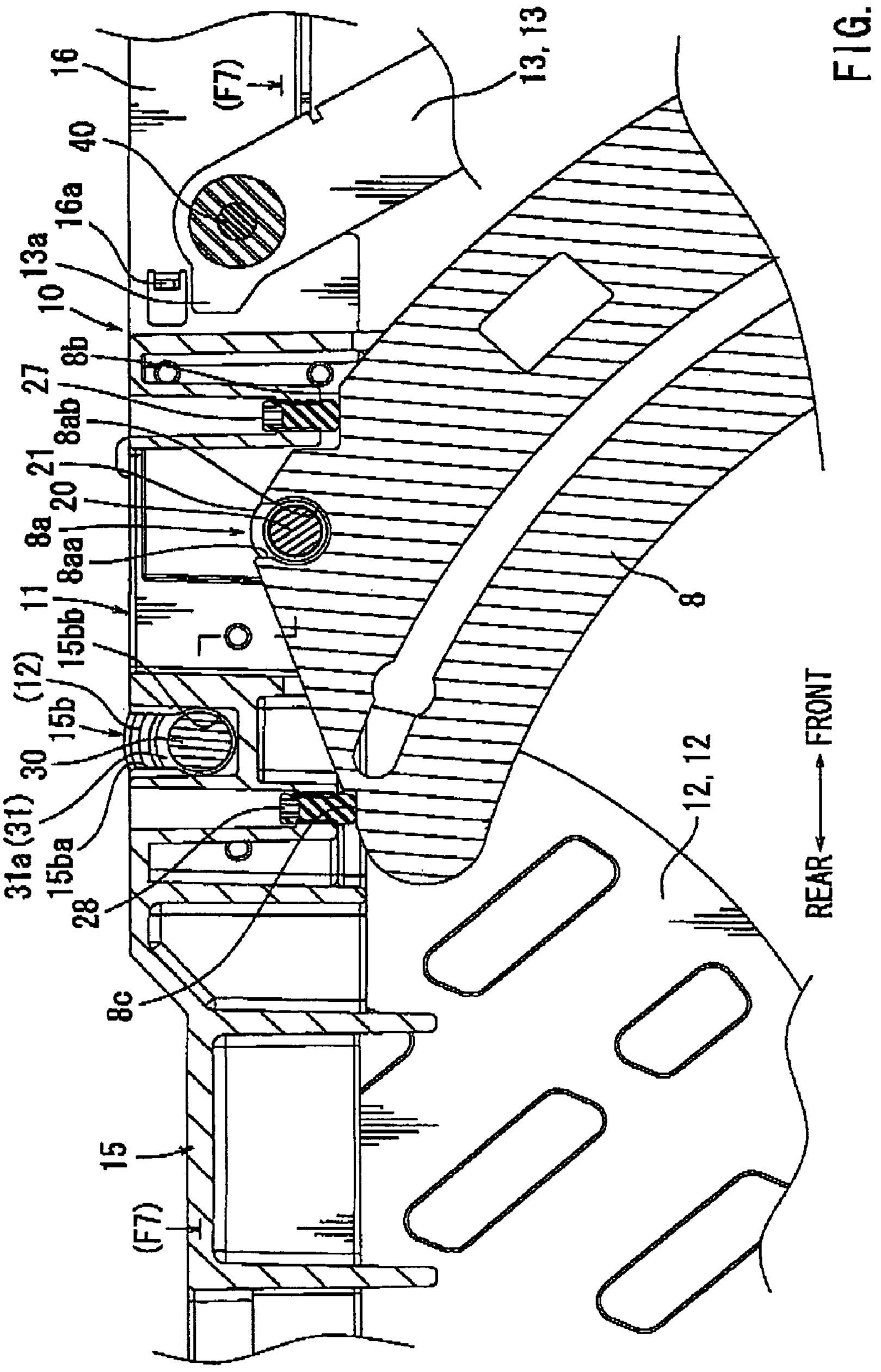
34
35
31
31
28
15
3
15d
12c
12
12a
H
12
12a
12b
T
FRONT
LEFT
RIGHT
REAR

FIG. 6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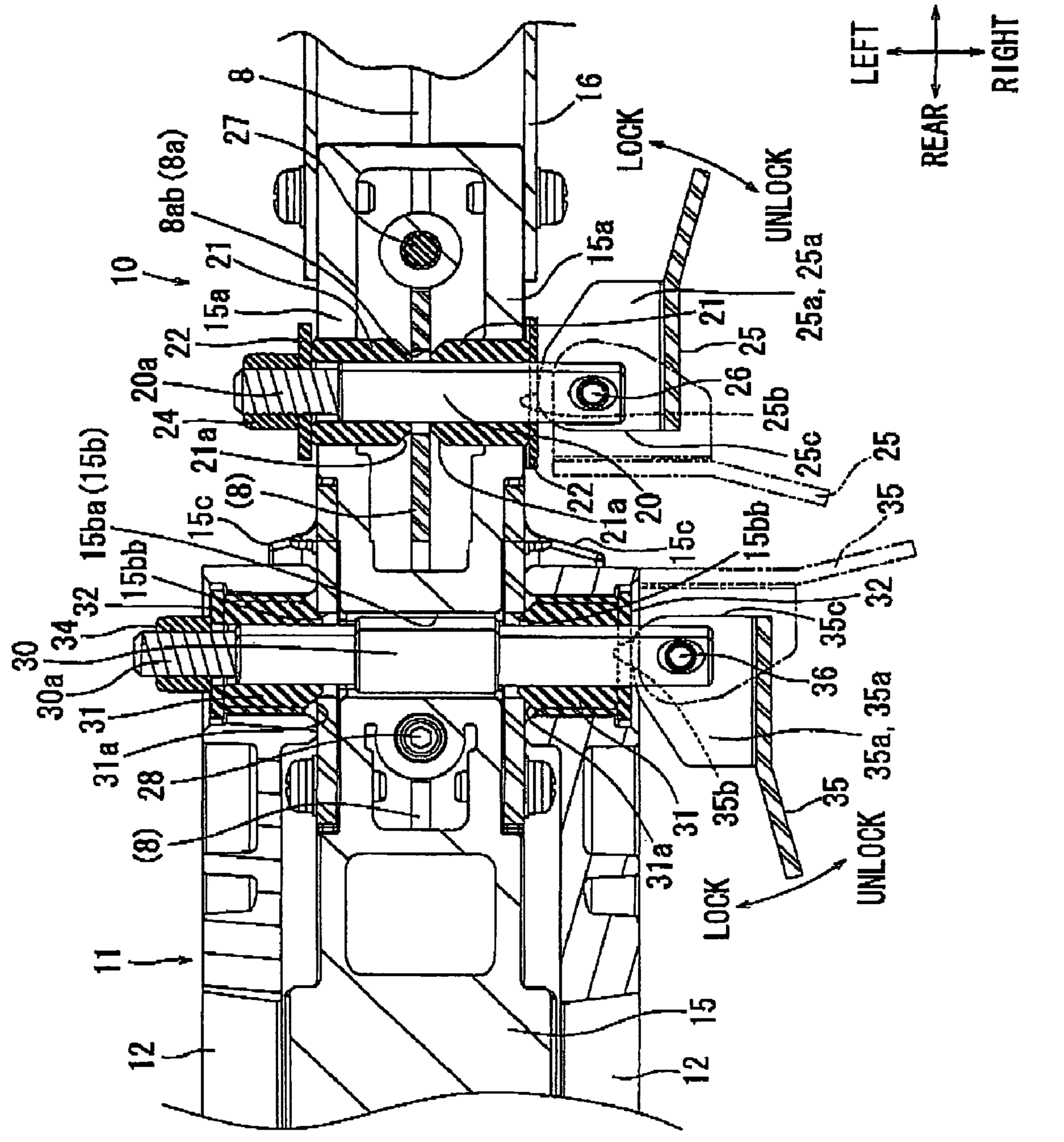
8aa
11
15bb
(12)
15b
30
31a (31)
15ba
28
8c
15
(F7)
8
12, 12
REAR
FRONT

FIG. 7


LEFT
FRONT
RIGHT
REAR
LOCK
UNLOCK
10
11
12
15
15a
15b
15ba
15bb
15c
16
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20a
21
21a
22
24
25
25a
25b
25c
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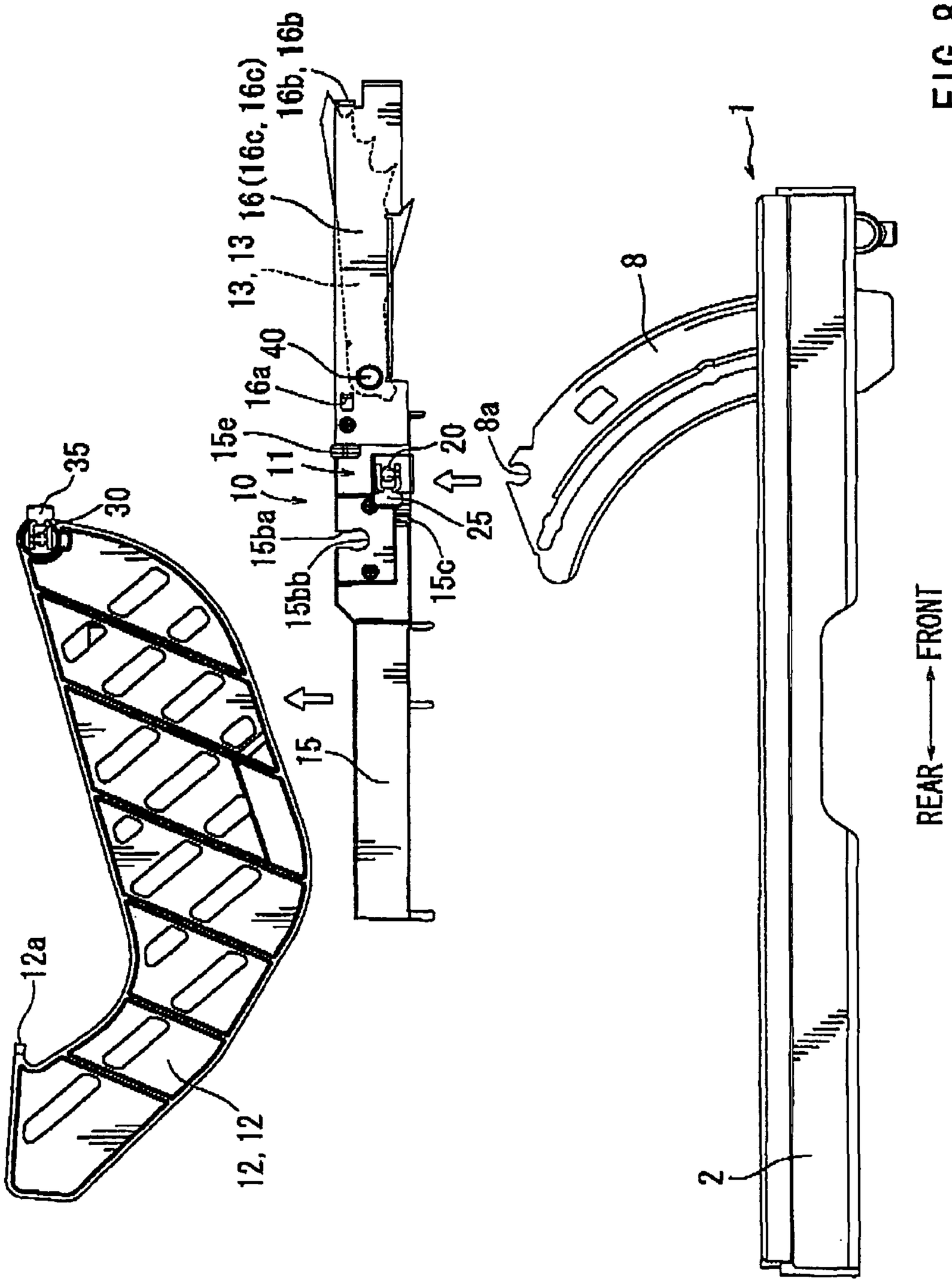
35b
35c
36
8
8ab (8a)
(8)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8a
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FRONT
16(16c, 16c)
16b, 16b
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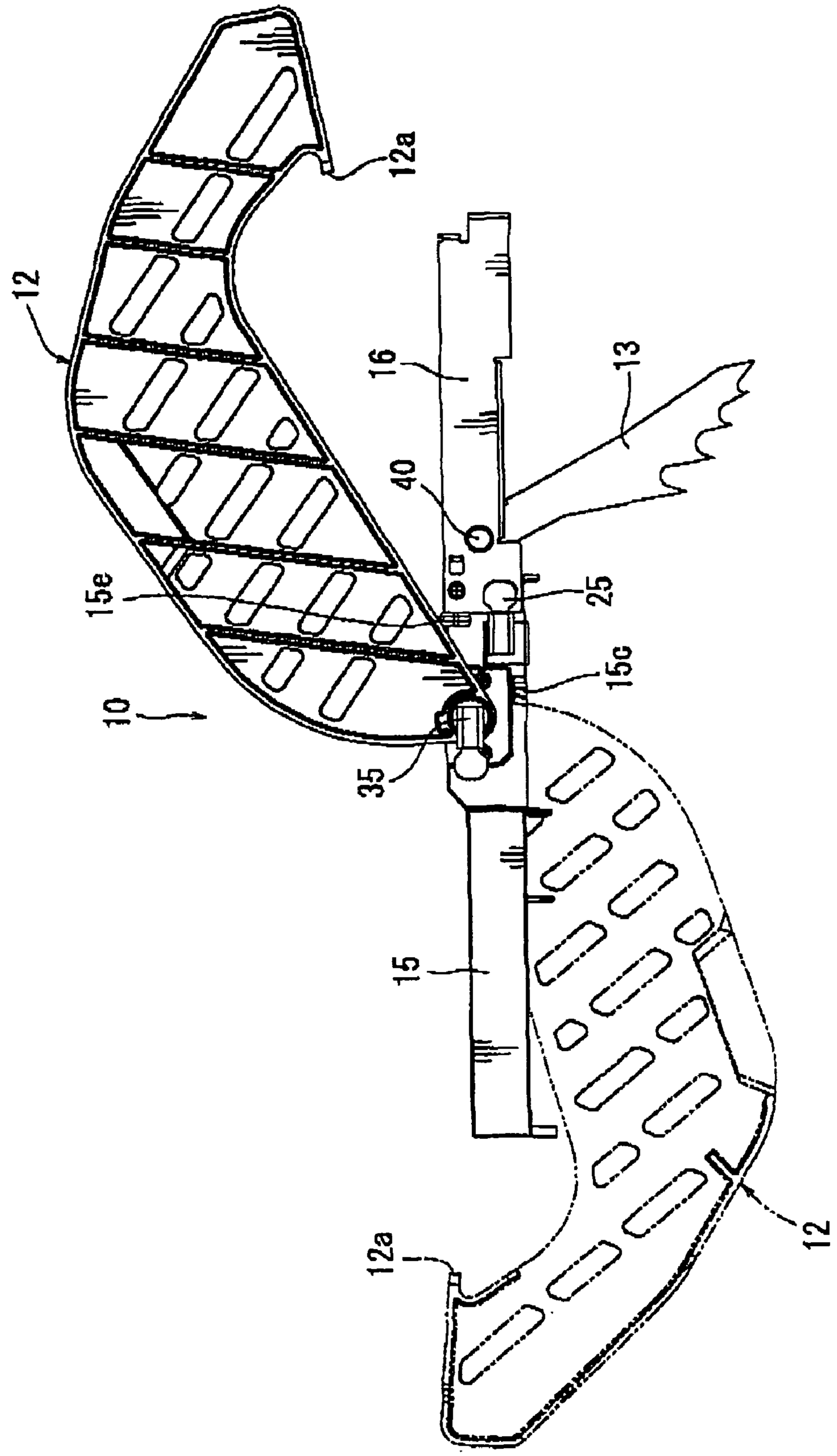
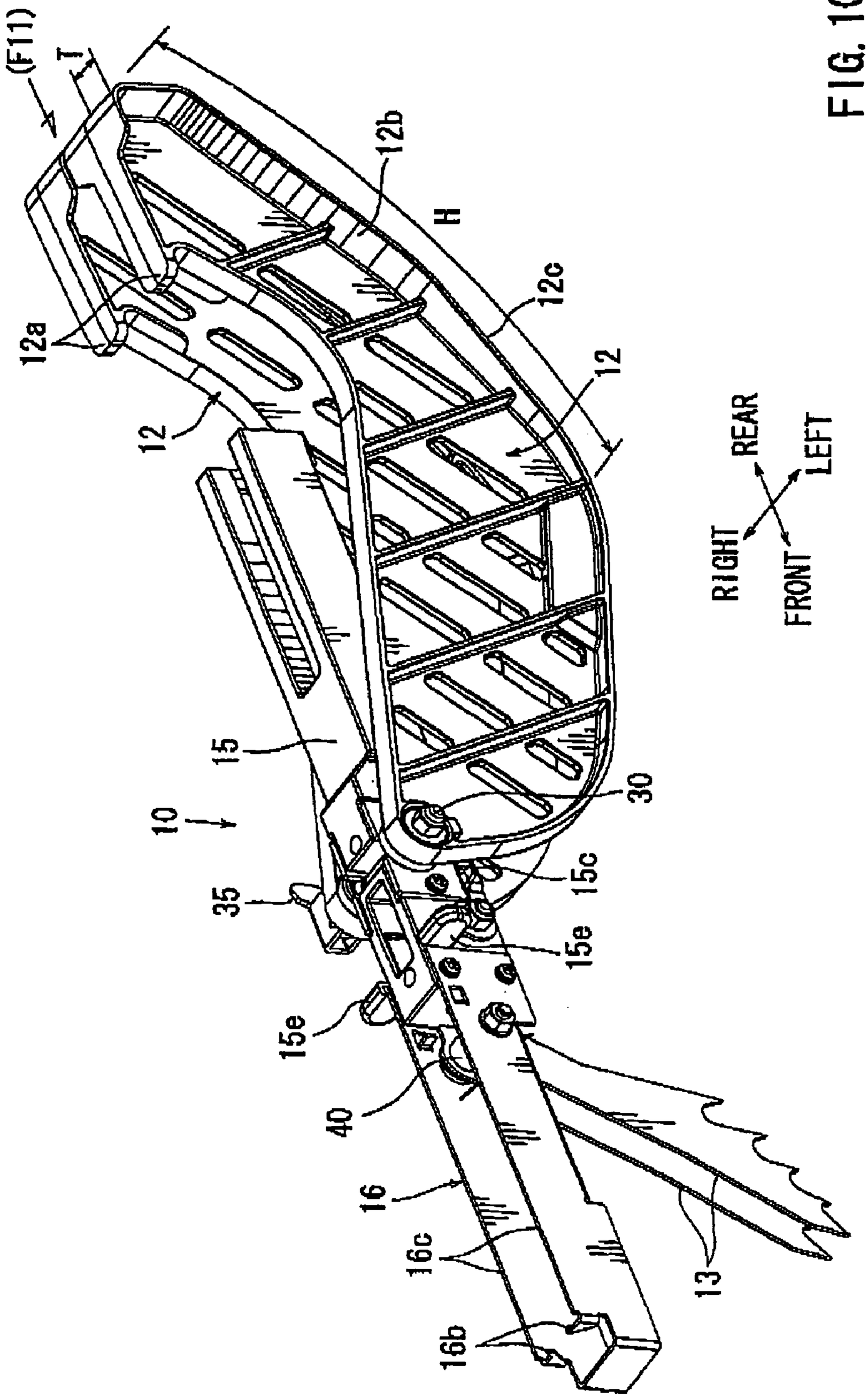
15c
35
30
12a
12, 12

FIG. 8

FIG. 9




(F11)
T
12b
H
12c
12a
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15c
15e
40
16
16c
16b
13
REAR
RIGHT
LEFT
FRONT

FIG. 10

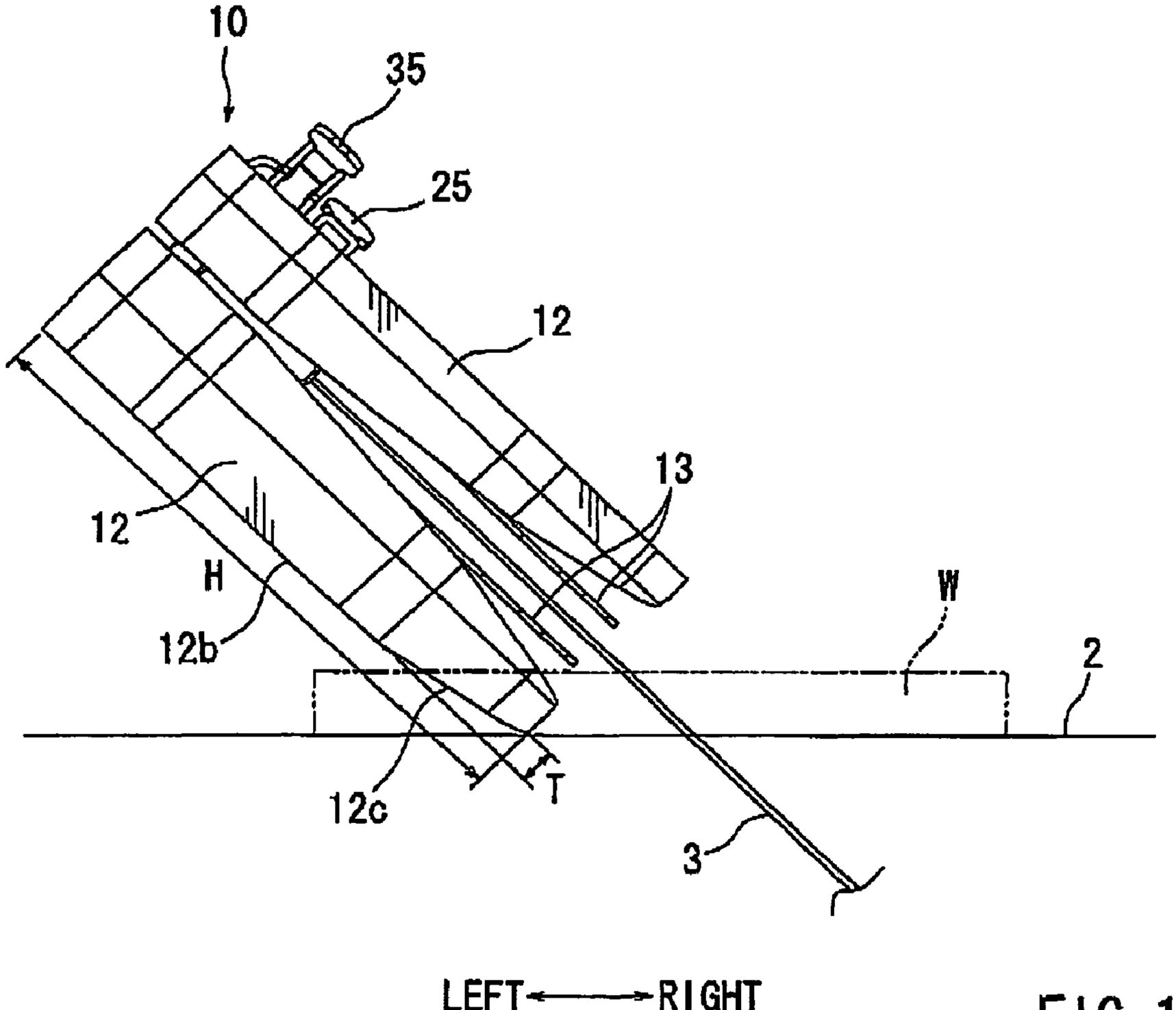

FIG. 11

SAW BLADE PROTECTORS

This application claims priority to Japanese patent application serial numbers 2008-60931 and 2008-205593, the contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present invention relates to protectors covering saw blades of cutting devices called as "table saws", in which an upper portion of a saw blade protrudes from an upper surface of a table, on which a workpiece is put.

According to a known table saw, an upper portion of a circular saw blade protrudes from an upper surface of a table, on which a workpiece is put, and cuts the workpiece when the workpiece is moved toward the saw blade along the table. In such a known table saw, a saw blade protector is generally provided in order to prevent other substance than the workpiece from contacting with the saw blade protruding upwardly from the table. The saw blade protector has guard plates covering mainly both right and left sides and upper side of the saw blade, and a mechanism configured to move the guard plates upwardly due to interaction with the workpiece moved toward the saw blade. In general, the guard plates are supported by a holding frame attached to an upper portion of a riving knife such that the guard plates can pivot upwardly and downwardly. It is preferred that the saw blade protector not only can merely pivot upwardly and downwardly, but also be completely removed together with the holding frame for, e.g., easy exchange of the saw blade.

With respect to the table saw, the saw blade rotates in such a direction that a rear side with respect to a cutting direction (i.e., the side of the operator) of the saw blade moves downwardly whereas a front side of the saw blade moves upwardly. Therefore, when the rear side of the saw blade rotating at high speed contacts with cut surfaces of the workpiece right after cutting, the workpiece may be forced to move upwardly (so-called "kickback phenomenon"). In such case, it is difficult to carry out cut process smoothly. Therefore, in a known table saw, a riving knife having the substantially same thickness as the saw blade is provided in front of the saw blade with respect to the cutting direction such that the saw blade and the riving knife are aligned in line. The width between opposite cut surfaces of the workpiece can be held at a predetermined distance by the riving knife positioned between the opposite cut surfaces in order to prevent the cut surfaces from contacting with the saw blade. In addition, kickback prevention claws for preventing the upward movement of the workpiece are disposed on opposite sides of the riving knife such that the kickback prevention claws does not inhibit the movement of the workpiece in the cutting direction during the cutting operation. Similar to the cover structure, the kickback prevention claws are supported by the holding frame.

US2007/0056416A1 (Japanese Laid Open Patent Publications No. 2007-76235) and US2005/0211034A1 (Japanese Laid-Open Patent Publications No. 2005-254671) disclose some techniques with respect to saw blade protectors, riving knives and kickback prevention claws.

The saw blade protectors disclosed in the above patent publications include neither a mechanism for adjusting the height of the holding frame fixed on the upper portion of the riving knife relative to the upper surface of the table nor a mechanism for adjusting inclination of the holding frame in forward and rearward directions with respect to a cutting direction or a direction parallel to the moving direction of a workpiece. Therefore, the inclination of the holding frame with respect to the cutting direction cannot be adjusted

depending on, e.g., processing accuracy and assembly accuracy of the related components, and thus, for example, it is not able to accurately control a vertical distance between a rear end of the holding frame (an end close to the operator) with respect to the cutting direction and the upper surface of the table in order to set a covering range of the guard plate for the saw blade.

Therefore, there has been a need for improved saw blade protectors capable of adjusting the position of a holding frame for supporting a guard plate(s) covering a saw blade in order to adjust the relative position of the guard plate(s) to the saw blade.

BRIEF SUMMARY OF THE INVENTION

According to a first aspect of the present invention, a saw blade protector for a cutting device having a table for placing thereon a workpiece, a saw blade protruding from an upper surface of the table, and a riving knife disposed in front of the saw blade in a moving direction of the workpiece for cutting the workpiece and positioned in line with the saw blade. The saw blade protector include a guard plate constructed to cover the saw blade, a holding frame constructed to be mounted on an upper portion of the riving knife and to be able to support the guard plate and an adjusting device constructed to be able to adjust a position of the holding frame relative to the upper surface of the table. Accordingly, it is able to alter the relative position of the guard plate to the saw blade by adjusting the position of the holding frame in the vertical direction.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a right side view of a cutting device having a saw blade protector according to an embodiment of the present invention;

FIG. **2** is a right side view of the saw blade protector according to the present invention;

FIG. **3** is a plane view of the saw blade protector according to the present invention;

FIG. **4** is a vertical cross sectional view of the saw blade protector according to the present invention;

FIG. **5** is a horizontal cross sectional view of the saw blade protector taken along a line (F**5**)-(F**5**) in FIG. **4**;

FIG. **6** is a partially enlarged vertical cross sectional view of FIG. **4**, showing an attachment configuration of the saw blade protector to the riving knife;

FIG. **7** is a vertical cross sectional view taken along a line (F**7**)-(F**7**) in FIG. **6**;

FIG. **8** is a right side view of the saw blade protector according to the present invention, where the saw blade protector is detached from the riving knife, and both guard plates are detached from the holding fee;

FIG. **9** is a right side view of the whole of the saw blade protector according to the present invention, where the guard plate in an evacuation position is depicted by solid line, whereas the guard plate in guard position is depicted by chain double-dashed line, and the saw blade protector is removed from the riving knife;

FIG. **10** is a perspective view of the saw blade protector according to the present invention; and

FIG. **11** is an elevation view of the saw blade protector according to the present invention viewed along an arrow (F**11**) in FIG. **10**.

DETAILED DESCRIPTION OF THE INVENTION

Each of the additional features and teachings disclosed above and below may be utilized separately or in conjunction

with other fires and teachings to provide improved saw blade protectors. Representative examples of the present invention, which examples utilized many of these additional features and teachings both separately and in conjunction with one another, will now be described in detail with reference to the attached drawings. This detailed description is merely intended to teach a person of skilled in the art further details for practicing preferred aspects of the present teachings and is not intended to limit the scope of the invention. Only the claims define the scope of the claimed invention. Therefore, combinations of features and steps disclosed in the following detailed description may not be necessary to practice the invention in the broadcast sense, and are instead taught merely to particularly describe representative examples of the invention. Moreover, various features of the representative examples and the dependent claims may be combined in ways that are not specifically enumerated in order to provide additional useful embodiments of the present teachings.

An embodiment will be described in reference to FIGS. **1-7**. FIG. **1** shows a whole structure of a cutting device **1** incorporating a saw blade protector **10** according to this embodiment. In the embodiment, a table saw is exemplified as the cutting device **1**. This embodiment is characterized by the construction of the saw blade protector **10** covering a saw blade **3** protruding from an upper surface of a table **2**, and therefore, the structure of the cutting device **1** other than the saw blade protector **10** will be described in brief.

The cutting device **1** includes the table **2** where a workpiece W is put on. A mount base **4** supports the table **2**, so that the upper surface of the table **2** extends substantially horizontally. The saw blade **3** has a circular configuration. An upper portion of the circular saw blade **3** protrudes upwardly from a substantially center portion of the table **2**. The saw blade **3** is supported by a lift base **5** disposed below the table **2**, and can be rotated by a driving motor **7**. Slide shafts **6** extending in the vertical direction and mounted on the mount base **4** support the lift base **5** such that the lift base **5** can move parallel in the vertical direction to an upper movable end show in FIG. **1**. Therefore, the protruding distance of an upper portion of the saw blade **3** from the upper surface of the table **2** (i.e., a depth of cut into the workpiece W) can be altered.

In order to perform a cutting operation, an operator may be positioned on the left side of the table **2** as viewed in FIG. **1**. The operator then moves the workpiece W toward the saw blade **3** in a cutting direction indicated by an outline arrow in FIG. **1** (moving direction of the workpiece W) in order to cut the workpiece W. Hereinafter, the terms of front and rear directions and right and left directions are used to mean directions as viewed from the side of the operator. Therefore, as indicated by the outline arrow in FIG. **1**, the saw blade **3** cuts the workpiece W as the workpiece W moves forward in the cutting direction. The side close to the operator corresponds to a rear side with t to the cutting direction.

A riving knife **8** is disposed in front of the saw blade **3** in the cutting direction (on the right side as viewed in FIG. **1**). The riving knife **8** is a flat plate having substantially the same thickness as the saw blade **3** and is positioned in line with the saw blade **3**. The riving knife **8** is attached to a mount portion **5***a*, which is provided on the lift base **5**, via an attachment base **9**, and its upper portion protrudes upwardly from the upper surface of the table **2**. The riving knife **8** has a first flat surface and a second flat surface on a circumference thereof (see, for example, bearing portions **8***b*, and **8***c* illustrated in FIG. **6**). The attachment base **9** has a mechanism for optionally and easily adjusting a protruding distance of the riving knife **8** from the upper surface of the table **2**. The riving knife **8** can be inserted between opposite cut surfaces of the workpiece W right after a cut in order to keep a distance between the opposite cut surfaces constantly, thereby preventing the opposite cut surfaces from contacting with the saw blade **3** in order to avoid kickback of the workpiece W.

A saw blade protector **10** according to this embodiment is provided at the upper end of the riving knife **8** protruding upwardly from the table **2**. A detailed configuration of the saw blade protector **10** is shown in FIG. **2** and its subsequent figures. The saw blade protector **10** has a holding frame **11** elongated in forward and rearward directions, a pair of guard plates **12**, and a pair of kickback prevention claws **13**.

The holding frame **11** includes a frame body portion **15** disposed on the side close to the operator, and an auxiliary frame portion **16** extending forwardly from a front end of the frame body portion **15**. The frame body portion **15** extends rearwardly from the upper portion of the riving knife **8**, and the auxiliary frame portion **16** extends forwardly from the upper portion of the riving knife **8**. A substantially central portion with respect to the longitudinal direction of the holding frame **11** or a portion of the holding frame **11** proximal to a connecting region between the fame body portion **15** and the auxiliary frame portion **16** is supported by the riving knife **8**. A detailed structure for supporting the holding frame **11** on the riving knife **8** is shown in FIGS. **6** and **7**.

A frame shaft **20** is supported near a front end of the frame body portion **15**. The fame shaft **20** is supported between supporting walls **15***a*, which are provided at a front section of the frame body portion **15** and are spaced away form each other in a transverse direction (right and left directions). A pair of lock sleeves **21** is attached to the frame shaft **20**. The lock sleeves **21** are attached to an outer circumference of the frame shaft **20** such that the lock sleeves **21** are movable in an axial direction and rotatable about the frame shaft **20** independently of each other, but cannot move in a radial direction. Tapered surfaces **21***a* are formed on inner ends of the lock sleeves **21** facing each other.

Outer ends of the lock sleeves **21** (opposite ends to the tapered surfaces **21***a*) bear against left and right flanges **22**, respectively. A threaded shaft portion **20***a* is formed on one end of the frame shaft **20** and protrudes outward from the left flange **22**. A fixing nut **24** is engaged with and tightened on the threaded shaft portion **20***a*. Whereas, the other end of the frame shaft **20** protrudes outward from the right flange **22**. A frame lever **25** is attached to this protruding portion of the frame shaft **20**. The frame lever **25** has a pair of parallel plates **25***a* to position the protruding portion of the frame shaft **20** therebetween. The frame lever **25** is pivotally supported by the protruding portion via a shaft **26** extending between the parallel plates **25***a*. A cam portion **25***b* is formed at one end of each plate **25***a* and has a cam edge that is spaced from the shaft **26** by a distance larger than a distance between a side edge **25***c* of each plate **25***a* and the shaft **26**. FIG. **7** shows a lock position of the frame lever **25**, where the cam portions **25***b* bear against the right flange **22**, respectively. In this state, the distance between the both flanges **22** become shorter, and the lock sleeves **21** become close to each other. Accordingly, since the riving knife **8** is firmly held between the tapered surfaces **21***a* as described below, the holding frame **11** and thus the saw blade protector **10** is fixed onto the riving knife **8**.

As the frame lever **25** moves from the lock position to an unlock position depicted by chain double-dashed line by rotating the frame lever **25** about the shaft **26** by an angle of 90-degrees in a clockwise direction (see a two-headed arrow on the right side in FIG. **7**), the cam edges of the cam portions **25***b* move not to face the right flange **22**, while the side edges **25***c* move to face to the flange **22**. In this unlock condition,

since the distance between the lock sleeves **21** becomes larger, fixation of the riving knife **8** may be released. Therefore, the frame shaft **20** can be moved upwardly in the radial direction and can be removed through a frame mounting opening **8***a* described below, so that the holding frame **11**, and thus, the saw blade protector **10** can be removed from the riving knife **8**. FIGS. **8-10** show a state where the saw blade protector **10** has been detached from the riving knife **8**.

As shown in FIG. **6**, the frame mounting opening **8***a* is formed in an upper end portion of the riving knife **8**. The frame mounting opening **8***a* has a keyhole shape opening upward and includes a narrowed portion **8***aa* and a circular-shape fixing portion **8***ab* continuously formed with the bottom of the narrowed portion **8***aa*. A width of the narrowed portion **8***aa* is smaller than a diameter of the fixing portion **8***ab* as shown in FIG. **6**. In addition, the width of the narrowed portion **8***aa* is larger than a diameter of the frame shaft **20**, and the diameter of the fixing portion **8***ab* is smaller than an outer diameter of each lock sleeve **21**.

Accordingly, as the frame lever **25** moves to the lock position depicted by solid line in FIG. **7**, the distance between the lock sleeves **21** becomes shorter due to the action of the cam portions **25***b*, so that the tapered surfaces **21***a* are pressed against a circumferential edge of the fixing portion **8***ab*, thereby firmly holding the riving knife **8** between the lock sleeves **21**.

On the other hand, as the frame lever **25** moves to the unlock position depicted by chain double-dashed line in FIG. **7**, the pressing condition of the tapered surfaces **21***a* against the circumferential edge of the fixing portion **8***ab* is released. In this state, the saw blade protector **10** can be removed from the riving knife **8** by lifting the saw blade protector **10** upwardly and removing the frame shaft **20** from the frame opening **8***a* through the narrowed portion **8***aa* as shown in FIG. **8**.

As shown in FIG. **6**, a pair of position adjusting screws **27** and **28** are threadably engaged with the frame body portion **15** so as to be attached thereto. These position adjusting screws **27** and **28** are positioned on the front side and the rear side of the frame shaft **20**, respectively. The position adjusting screws **27** and **28** can contact with bearing portions **8***b* and **8***c* formed on the upper end of the riving knife **8**, respectively. The distances between the lower ends of the position adjusting screws **27** and **28** and the lower surface of the frame body portion **15** can be adjusted by rotating the position adjusting screws **27** and **28** for changing the protruding distances of the lower ends of the position adjusting screws **27** and **28**.

Accordingly, if the protruding distance of the position adjusting screw **27** positioned on the front side is larger than protruding distance of the position adjusting screw **28** positioned on the rear side, the holding frame **11** may be tilted about the frame shaft **20** in the counterclockwise direction in FIG. **6**, and thus, the holding frame **11** can be tilted such that the rear end (the end close to the operator) of the holding frame **11** moves downwardly.

On the other hand, if the protruding distance of the position adjusting screw **27** positioned on the front side is smaller than the protruding distance of the position adjusting screw **28** positioned on the rear side, the holding frame **11** may be tilted about the frame shaft **20** in the clockwise direction in FIG. **6** such that the rear end of the holding frame **11** moves upwardly. In this way, with respect to the holding frame **11**, the inclination toward the right or left direction and the distance from the upper surface of the table **2** can be finely adjusted by controlling the protruding distances of the position adjusting screws **27** and **28**.

The pair of the right and left guard plates **12** is supported near the center portion with respect to the longitudinal direction of the holding frame **11** (on the frame body portion **15** in this embodiment). More specifically, the guard plates **12** are vertically pivotally supported by the frame body portion **15** via a guard shaft **30**. These guard plates **12** cover right and left sides of the saw blade **3** in order to prevent dust generated by the cutting process from scattering.

The guard plates **12** can pivot independently on each other. Downward pivotal movements (in the counterclockwise direction in FIG. **2**) of the guard plates **15** can be restricted by lower guard stoppers **15***c* mounted on opposite side portions of the frame body portion **15**, respectively. The lower guard stoppers **15***c* protrude laterally from the side portions at positions substantially directly below the guard shaft **30**. When the lower guard stoppers **15***c* contact with front sections of guard plates **12**, downward pivotal movements of guard plates **12** can be stopped.

In addition, upward pivotal movements (in the clockwise direction in FIGS. **2** and **9**) of the guard plates **12** can be restricted by upper guard stoppers **15***e* mounted on opposite side portions of the frame body portion **15**. As shown in FIG. **9**, when the guard plate **12** pivots upwardly by an angle of about 180 degrees from a guard position depicted by chain double-dashed line to a rest position depicted by solid line, the guard plate **12** contacts with the corresponding upper guard stopper **15***e* from above, so that firer pivotal movement of the guard plate **12** can be inhibited. In this way, when the guard plates **12** are supported by their corresponding upper guard stoppers **15***e* from below, the guard stoppers **12** can be held at the rest positions depicted by solid line in FIG. **9**. In addition, by holding the guard plates **12** at the rest positions by the upper guard stoppers **15***e* while the holding frame **11** is detached, it is able to prevent unintended movement of the guard plates **12** during carrying the holding frame **11**, and thus it is able to easily carry the holding frame **11**. The upper guard stoppers **15***e* are covered with elastic covers in order to prevent the guard plates **12** from being damaged or deformed due to contact with the guard stoppers **15***e*. In FIG. **9**, the guard plates **12** held by the lower guard stoppers **15***c* at the guard position are depicted by chain double-dashed line.

As shown in FIG. **8**, hook portions **12***a* for engaging with fingers of the operator are formed on upper ends on the side away from the guard shaft **30** of the guard plates **12** in order to facilitate the pivoting operation of the guard plates **12**. The hook portions **12***a* are formed integrally with the corresponding guard plates **12** such that the hook portions **12***a* protrude toward the pivotal axis of the guard plates **12** (i.e., the axis of the guard shaft **30**).

In the state that the protector **10** is attached to the riving knife **8** as shown in FIGS. **1** and **2**, or that the protector **10** is detached from the riving knife **8** as shown in FIGS. **9** and **10**, the operator can engage his or her fingers with either one of the hook portions **12***a* of the guard plates **12** in order to pivot the guard plates **12** independently of each other.

The guard shaft **30** extends parallel to the frame shaft **20** and is positioned on the rear side of the frame shaft **20**. The guard shaft **30** also has a pair of lock sleeves **31**. The lock sleeves **31** are attached to an outer circumference of the guard shaft **30** such that the lock sleeves **31** can move in axial direction and can rotate about tie guard shaft **30** dependently of each other but cannot move in a radial direction. The guard plates **12** are rotatably mounted on opposite ends of the guard shaft **30** via the lock sleeves **31**, respectively.

The lock sleeves **31** have tapered surfaces **31***a* at inner ends facing each other.

Outer ends (opposite ends to the tapered surfaces **31***a*) of the lock sleeves **31** contact with right and left flanges **32**, respectively. A threaded shaft portion **30***a* formed on one end of the guard shaft **30** protrudes beyond the left flange **32** as shown in FIG. **7**. A fixing nut **34** is threadably engaged with the threaded shaft portion **30***a*. Whereas, the other end of the guard shaft **30** protrudes beyond the right flange **32**. A guard lever **35** is attached to the other end of the guard shaft **30**. The guard lever **35** has a pair of parallel plates **35***a*. The protruding portion of the guard shaft **30** enters between the parallel plates **35***a*. The guard lever **35** is rotatably supported by this protruding portion via a shaft **36** wending between the parallel plates **35***a*. A cam portion **35***a* is formed at one end of each plate **45***a* and has a cam edge that is spaced from the shaft **26** by a distance larger than a distance between a side edge portion **35***c* of each plate **45***a* and the shaft **26**. FIG. **7** shows a lock position of the guard lever **35**, where cam portions **35***b* contact with the right flange **32**, respectively. In this state, the distance between the both flanges **32** becomes shorter, and the lock sleeves **31** become close to each other. Accordingly, the frame body portion **15** can be firmly held between the tapered surfaces **31***a*, so that the guard shaft **30** and thus the guard plates **12** can be supported by the holding frame **11**.

In the state when the guard plates **12** are firmly held, as the guard lever **35** moves from the lock position to an unlock position by pivoting the guard lever **35** about the shaft **36** in the counterclockwise direction as indicated by a two-headed arrow on the left side in FIG. **7**, the cam portions **35***b* move not to face with the right flange **32**, while and the side edges **35***c* move to face to the flange **32**. In this unlock condition, since the distance between the lock sleeves **32** becomes larger, tightening of the frame body portion **15** can be released. Therefore, the guard shaft **30** can be moved upwardly in the radial direction and can be removed through a guard mounting opening **15***b* described below, so that the guard plates **12** can be detached from the frame body portion **15**, and thus the guard plates **12** can be removed from the holding frame **11** together with the guard shaft **30**. FIG. **8** shows the guard plates **12** detached from the holding frame **11**.

The guard mounting opening **15***b* is formed on the frame body portion **15**. Similar to the frame opening **8***a* of the riving knife **8**, the guard opening **15***b* has a keyhole shape opening upward, and includes a narrowed portion **15***ba* and a circular fixing portion **15***bb* continuously formed with the bottom of the narrowed portion **15***ba*. The width of the narrowed portion **15***ba* is smaller than the diameter of the fixing portion **15***bb*. In addition, the width of the narrowed portions **15***ba* is larger than the diameter of the guard shaft **30**, and the diameter of the fixing portions **15***bb* is smaller than the outer diameter of each lock sleeve **31**. Accordingly, when the guard lever **35** has pivoted to the lock position as shown in FIG. **7**, the tapered surfaces **31***a* of the lock sleeves **31** are pressed against edges of the corresponding fixing portions **15***bb* from opposite sides, and thus the frame body portion **15** can be firmly clamped between the lock sleeves **31**.

When the guard lever **35** has pivoted to the unlock position, the pressing force applied by the tapered surfaces **31***a* against the edges of the fixing portions **15***bb* is released. In this state, the guard plates **12** can be detached from the holding frame **11** by lifting the guard shaft **30** upwardly in the radial direction and withdrawing the same from the guard openings **15***b* (including the narrowed portions **15***ba* and the fixing portions **15***bb*) as shown in FIG. **8**.

As shown in FIG. **3**, a rear section (a front section as viewed from the side of the operator) of the frame body portion **15** has a bifurcated shape and includes a slot (or a window portion **15***d* used as a view window for positioning the workpiece W) having a constant width and extending in the longitudinal direction. The operator can look at a cut portion of the workpiece W through the window portion **15***d* from above, and therefore, the operator can position the workpiece W relative to the saw blade **3** and then can perform a cutting operation in a comfortable position.

The pair of kickback prevention claws **13** is supported by the auxiliary frame portion **16** or a front side part of the holding frame **11**. The auxiliary frame portion **16** has a U-shaped configuration. A shaft **40** is supported such that the shaft **40** extends between the opposite wall portions **16***c* of the auxiliary frame portion **16**. The kickback prevention claws **13** are vertically pivotally supported by the auxiliary frame portion **16** via the shaft **40**. The kickback prevention claws **13** are biased downwardly by torsion springs **41**. In addition, stopper portions **13***a* are formed on the kickback prevention claws **13**, respectively. Stopper projections **16***a* are provided on the opposite walls **16***c* of the auxiliary frame portion **16** and protrude inwardly to correspond to the stopper portions **13***a*. When the stopper portions **13***a* contact with the stopper projections **16***a* from below, downward pivotal movements (in the clockwise direction in FIG. **4**) of the kickback prevention claws **13** are restricted.

In a normal usage condition that the saw blade protector **10** is attached to the riving knife **8**, the kickback prevention claws **13** contacts the upper surface of the table **2**, the upper surface of the table **2** prevents the kickback prevention claws **13** from pivoting further downwardly. When the riving knife **8** protrudes from the upper surface of the table **2** by a large distance as shown in FIG. **2** (FIG. **2** shows a state that the riving knife **8** is positioned at the highest position), or when the saw blade protector **10** is removed from the riving knife **8**, the stopper portions **13***a* may contact the stopper projections **16***a*, and thus, the downward pivotal movements of the kickback prevention claws **13** can be restricted.

The pivotal movements of the kickback prevention claws **13** are restricted to the area in front of a vertical line passing through the shaft **40** due to contact of the stopper projections **16***a* with the stopper portions **13***a*. In this embodiment, the pivotal movement of the kickback preventing claws **13** is restricted such that when the saw blade **3** is positioned to be perpendicular to the upper surface of the table **2** (a vertically cutting position), end portions of the kickback prevention claws **13** are spaced away from the upper surface of the table **2** (lower limit position) by a predetermined distance. By setting the lower limit position in this way, for example, during an oblique cutting operation where the saw blade **3** and the riving knife **8** are inclined laterally with respect to the moving direction of the workpiece W, it is able to prevent the end portions of the kickback prevention claws **13** from contacting with the upper surface of the table **2** without need of lifting the end portions by a hand of the operator.

Holding projections **16***b* that project inwardly are provided on a front end of the auxiliary frame portion **16** in order to hold the kickback prevention claws **13** at rest positions, where the kickback prevention claws **13** are pivoted upward. By pivoting the kickback prevention claws **13** upwardly against the torsion springs **41** and positioning the end portions of the kickback prevention claws **13** to rest on the holding projections **16***b* as shown in FIG. **8**, the kickback prevention claws **13** cam be held between the wall portions **16***c* of the auxiliary frame portion **16**. The kickback prevention claws **13** can be kept at the rest positions due to the biasing forces of the torsion springs **41**.

Since the kickback prevention claws **13** can be held between the wall portions **16***c* as shown in FIG. **8**, it is able to prevent the kickback prevention claws **13** from contacting

with other substances when the kickback prevention claws **13** are not used, or when the saw blade protector **10** is detached.

As shown in FIGS. **10** and **11**, an auxiliary flange portion **12***b* is formed on one of the guard plates **12** positioned on the left side as viewed from the side of the operator. The auxiliary flange portion **12***b* is formed in a lower rear section of the guard plated **12** along approximately a quarter (90 degrees) of a circumferential length of the guard plate **12** as indicated by a range H in FIG. **10**. A protruding width of auxiliary flange portion **12***b* becomes larger toward a rear end of the guard plate **12** (the end close to the operator), and the flange portion **12***b* has the greatest width T around the rear end. As clearly shown in FIG. **11**, the width of the left guard plate **12** is broader than the width of the right guard plate **12** because of increase in width to the greatest width T. An inclined edge portion **12***c* extends along nearly the front half of the auxiliary flange portion **12***b* (within the range H), which gradually becomes broader toward the rear end. The inclined edge portion **12***c* serves to contact with the workpiece W during the oblique cutting operation.

In the case of the vertical cutting operation, where the saw blade **3** extends perpendicular to the upper surface of the table **2**, no substantial problem may be caused since the workpiece W contacts with rear surfaces of the guard plates **12** evenly. On the other hand, in the case of the oblique cutting operation, where the saw blade **3** is inclined, (e.g., at 45 degrees in the left direction), the guard plates **12** are inclined leftward together with the saw blade **3**. In this condition, mainly the inclined edge portion **12***c* of the auxiliary flange **12***b* of the left guard plate **12** located at a lower position than the right guard plate **12** may contact with the workpiece W that is moved forwardly by the operator.

In the case of such a leftward oblique cutting, the left edge portion (within the range H) of the left guard plate **12** is tilted relative to the upper surface of the table **2** both in the longitudinal direction (forward and rearward directions) and the transverse direction (right and left directions), and the left side and the front side of the left edge portion is positioned to be lower than the right side and the front side, respectively. Therefore, without any countermeasure, the workpiece W may be wedged between the upper surface of the table **2** and the left guard plate **12**, and thus, the left guard plate **12** may not pivot smoothly upward.

However, according to this embodiment, the inclined edge portion **12***c* is formed on the left side portion of the left guard plate **12** as described above. Accordingly, this inclined edge portion **12***c* works as a relief portion, thereby preventing the workpiece W from wedging. Furthermore, the pressing force applied to the guard plate **12** by the movement of the workpiece W may be applied as a force for pressing the guard plate **12** upwardly due to the action of the inclined edge portion **12***c*, and thus, the guard plate **12** can be pivoted smoothly upward.

By providing an auxiliary flange portion, which is similar to the auxiliary flange portion **12***b*, on the right guard plate **12**, the same effect can be obtained when a rightward oblique cutting is performed.

In accordance with the saw blade protector **10** described above, the holding frame **11** supporting the both right and left guard plates **12** is supported such that the holding frame **11** can be tilted in the longitudinal direction (forward and rearward directions) about the frame shaft **20**. In addition, by adjusting the protruding distance of the position adjusting screws **27** and **28** positioned on the front side and the rear side of the frame shaft **20**, respectively, fine adjustment of inclination in the longitudinal direction of the holding frame **11** and thus the height of the holding frame **11** from the upper surface of the table **2** is achieved. By finely adjusting the height of the holding frame **11**, the heights of the right and left guard plates **12** relative to the saw blade **3** are adjustable in order to set the covering area adequately.

In addition, by adjusting the position adjusting screws **27** and **28** such that the position adjusting screws **27** and **28** bear against the bearing portions **8***b* and **8***c* of the riving knife **8** by large forces, respectively, the holding frame **11** can be firmly fixed with respect to the tilting direction.

Furthermore, according to the saw blade protector **10** of this embodiment, since the height (distance L in FIG. **2**) of the rear end portion on the side of the operator of the holding frame **11** can be adjusted, it is able to certainly ensure a function required for this type of cutting device **1**.

In accordance with the saw blade protector **10** of this embodiment, it is able to easily remove the guard plates **12** and the kickback prevention claws **13** at a time without need of tools, such as spanners, by pivoting the frame lever **25** toward the unlock position, and thus, maintenance works, such as exchange of the saw blade **3**, can be carried out rapidly and efficiently. On the other hand, in an assembly operation, it is only necessary to pivot the frame lever **25** toward the lock position after inserting the frame shaft **20** into the frame opening **8***a* of the riving knife **8**, and thus it is able to easily carry out the assembly operation without need of any specific tools.

By pivoting the guard lever **35** toward the unlock position, the right and left guard plates **12** can be easily removed from the holding frame **11** while the holding frame **11** is attached to the riving knife **8**. Therefore, the cutting operation can be carried out in the state that only the holding frame **11** and the kickback prevention claws **13** are attached to the riving knife **8**, and that the guard plates **12** are removed from the saw blade **3**.

As shown in FIG. **8**, the saw blade protector **10** can be detached from the riving knife **8**, and the both guard plates **12** can be removed from the holding frame **11**. Therefore, the components can be easily exchanged and repaired, so that the maintenance work can be further easily performed.

When the stopper portions **13***a* of the kickback prevention claws **13** contact with the corresponding stopper projections **16***a* of the auxiliary frame **16**, the downward pivotal ranges of the kickback prevention claws **13** are restricted not to exceed the vertical line passing through the shaft **40**, and thus it is able to easily adapt the kickback prevention claws **13** to the oblique cutting operation, where the saw blade **3** is inclined leftward or rightward with respect to the cutting direction. In addition, during the assembly operation of the saw blade protector **10** to the riving knife **8**, the kickback prevention claws **13** can be positioned for certainly performing their functions without need of holding the kickback prevention claws **13** within given ranges, e.g., by hand.

The kickback prevention claws **13** can be held inside of the auxiliary frame **16** as shown in FIG. **8**, and therefore, other things, such as a hand tool, can be prevented from interfering with the kickback prevention claws **13**.

The guard stoppers **15***c* can restrict the downward pivotal ranges of the right and left guard plates **12**, and thus unintended movements of the guard plates **12** can be prevented when in the state that the saw blade protector **10** is removed from the riving knife **8**. Therefore, efficiency of the assembly operation and the handling property in the detached state can be improved.

The embodiment described above can be variously modified. For example, although it is exemplified that the saw blade protector **10** is attached to the riving knife **8** by clamping the riving knife **8** between the pair of the lock sleeves **21**

supported by the frame shaft **20** due to action of the cam portion **25***b* of the frame lever **25**, the saw blade protector **10** can be attached to the riving knife **8** by inserting the frame shaft **20** into the wall portions **15***a* and the riving knife **8**. Also, in such a configuration, the holding frame **11** and thus the saw blade protector **10** can be firmly fixed to the riving knife **8** and the height and the inclination angle of the holding frame **11** can be adjusted by adjusting the protruding distance of the position adjusting screws **27** and **28** positioned on the front side and the rear side of the frame shaft **20**.

With respect to the support structure of the guard plates **12** against the holding frame **11**, although a single step attaching/detaching mechanism by the operation of the lever (which is similar to the attaching/detaching mechanism of the holding frame **11** to the riving knife **8** is exemplified), the guard plates **12** may be configured such that the guard plates **12** cannot be removed from the holding frame **11**. On the other hand, the single step attaching/detaching mechanism by the operation of the lever can be also applied to the kickback prevention claws **13**.

The present invention can also be applied to a saw blade protector that does not have kickback prevention claws **13**. In such a case, the auxiliary frame **16** can be omitted.

The invention claimed is:

1. A saw blade protector for a cutting device having a table for placing thereon a workpiece, a saw blade protruding from an upper surface of the table, and a riving knife disposed in front of the saw blade in a moving direction of the workpiece for cutting the workpiece and positioned in line with the saw blade, the riving knife having a first flat surface and a second flat surface on a circumference thereof, the saw blade protector comprising:

a guard plate constructed to cover the saw blade;

a holding frame constructed to be mounted on an upper portion of the riving knife and to be able to support the guard plate, and

an adjusting device having a first adjusting member and a second adjusting member that contact with the first flat surface and the second flat surface of the riving knife, respectively, the first adjusting member and the second adjusting member being movably and directly mounted on the holding frame in order to adjust a position of the holding frame relative to the upper surface of the table.

2. The saw blade protector according to claim **1**, wherein:

the holding frame can pivot relative to the upper portion of the riving knife about a pivotal axis substantially parallel to the upper surface of the table, and

the adjusting device can adjust the position of the holding frame about the pivotal axis.

3. The saw blade protector according to claim **1**, wherein:

the first adjusting member and the second adjusting member can change a position relative to the holding frame independently of each other.

4. The saw blade protector according to claim **1**, wherein at least one of the first adjusting member and the second adjusting member is formed in a screw shape.

5. The saw blade protector according to claim **4**, wherein the first adjusting member and the second adjusting member are disposed parallel to each other.

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